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Recoil velocities from black hole mergers using perturbation theory PRANESH A. SUNDARARAJAN, Massachusetts Institute of Technology, GAURAV KHANNA, University of Massachusetts, Dartmouth, SCOTT A. HUGHES, Massachusetts Institute of Technology — Comparable mass black hole binaries radiate gravitational energy as they spiral into each other and merge. An integration of the momentum carried away by gravitational waves from asymmetric binaries results in a non-zero recoil velocity of the merged object. We have recently developed a numerical toolkit to study gravitational radiation from the viewpoint of black hole perturbation theory, where the binary consists of a massive central black hole (mass=M1) and a much smaller companion (mass=M2). The central engine of our numerical toolkit is a finite-difference based numerical algorithm to solve the inhomogeneous Teukolsky equation, which describes perturbations around black holes. Earlier calculations have shown that perturbation theory with M2/M1 = O(0.1) yields reliable estimates for the recoil velocity. Here, we use our numerical toolkit to improve earlier estimates for the recoil velocities from black hole mergers. Our numerical toolkit also allows us to compute fluxes of angular momentum during the merger. We compare these results with (3+1) dimensional numerical relativity. Such a comparison is both a calibration of the reliability of our code and a consistency check for numerical relativity.

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